

Fire Protection Engineering



7

7.0	TABLE OF CONTENTS		
7.1	General Approach	7.13	Portable Fire Extinguishers and Cabinets
	221 Introduction		
	221 General	7.14	Fire Protection for Storage Facilities
7.2	Certificate of Occupancy	7.15	Special Fire Protection Requirements
7.3	Fire Safety During Construction and Renovations		233 Essential Electronic Facilities
7.4	Commissioning		234 Elevator Systems
7.5	Building Construction		234 Atrium Smoke Removal System
	224 Fireproofing		235 Smoke Control Systems
7.6	Interior Finishes		235 Fire Protection Requirements for Cooling Towers
7.7	Occupancy Classifications		235 Child Care Centers
7.8	Means of Egress		235 Courthouses
7.9	Water Supply for Fire Protection		235 Border Stations
	227 Fire Pump Installation		235 Laboratories
7.10	Water Based Fire Extinguishing Systems	7.16	Emergency Power, Lighting and Exit Signage
	228 Automatic Sprinkler System Installation	7.17	Fire Alarm Systems
	228 Sprinkler System Design		236 Fire Alarm System Installation
	228 Types of Sprinklers		237 Manual Fire Alarm Stations
	229 Sprinkler Piping System		237 Waterflow
	229 Special Sprinkler System Requirements		237 Smoke Detectors
7.11	Non-Water Based Fire Extinguishing Systems		237 Audible Notification Appliances
7.12	Standpipes and Fire Department Hose Outlets		238 Visible Notification Appliances
			238 Fire Alarm Messages for High Rise Occupancies
			239 Graphic Annunciator
			239 Survivability
			239 Fire Command Center
		7.18	Historic Structures
	James H. Quillen United States Courthouse		
	Greeneville, Tennessee		
	Architect: Kallmann McKinnell & Wood Architects, Inc.		
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	Photo: Robert M. Fouts		
220	FACILITIES STANDARDS FOR THE PUBLIC BUILDINGS SERVICE		
7.0	Table of Contents		Revised March 2003 – PBS-P100

7.1 General Approach

Introduction

GSA's approach in the construction of new facilities and renovation projects is to design facilities that incorporate efficient, cost-effective fire protection and detection systems that are effective in detecting and extinguishing or controlling a fire event. The primary goal is to protect human life from fire and products of combustion. The secondary goals are to reduce the potential loss from fire (i.e., Federal real and personal property and maintain client agency mission continuity) to the Federal Government and taxpayer.

General

Scope. This chapter provides the technical fire protection requirements and design criteria for GSA facilities to meet the goals identified above. The majority of the fire protection requirements are contained in numerous national codes and standards. Compliance with national codes and standards is explained, and areas where GSA's requirements differ from the referenced national codes and standards are delineated. The Authority Having Jurisdiction (AHJ), for all technical requirements of this chapter, for all fire protection and life safety code interpretations and code enforcement requirements is the GSA regional fire protection engineer.

Applicability. The technical fire protection requirements are primarily directed to the construction of new facilities and renovation projects. Performance based designs are encouraged.

A registered fire protection engineer is required to be a full participant of the architect/engineer (A/E) design team for the project. The design team fire protection engineer must have at least 6 years experience from which at least 3 consecutive years are directly involved in the fire protection engineering field. This same or an equally competent professional must remain on the A/E's project staff for the entire design of the project and shall perform the design of all fire protection and life safety systems including but not limited to: building construction, occupancy classifications, means of egress, water supply, fire alarm system(s), water based fire extinguishing systems, non-water based fire extinguishing systems, fire dynamics calculations, egress calculations, smoke control calculations, etc. See Appendix A for specific submission requirements.

For all projects involving fire protection engineering issues, a dialog must be established between the design team fire protection engineer and the GSA regional fire protection engineer. The GSA regional fire protection engineer shall have the right to revise the specific requirements within this chapter based on a technical evaluation/analysis and the project's specific need.

Deviations from established requirements are allowed when the Design Team's registered fire protection engineer performs an assessment that analyzes the risks. The GSA regional fire protection engineer shall review the technical documentation to determine that the proposed alternative design is deemed equivalent or superior to the intent of the prescribed requirements of this chapter. Refer to Chapter 1 for additional information.

7.2 Certificate of Occupancy

No new building or portion thereof shall be occupied until the regional fire protection engineer has issued a certificate of occupancy to the GSA Project Manager. Issuance of a certificate of occupancy shall not be construed as an approval of any violation of a Code or GSA design standard or criteria.

Once the regional fire protection engineer has ensured that to the best of their knowledge all fire protection and life safety systems have been completed, inspected, successfully tested and approved and all outstanding fire and life safety deficiencies have been corrected to afford a reasonable degree of safety to the building occupants from fire and similar emergencies, a certificate of occupancy will be issued to the GSA Project Manager.

The regional fire protection engineer is authorized to issue a temporary certificate of occupancy. This certificate shall allow partial occupancy of specific areas, prior to completion of the building. All life safety and fire protection systems serving the areas proposed for occupancy and all floors below shall be completed, inspected, successfully tested and approved by the regional fire protection engineer. The temporary certificate of occupancy shall identify the specific area(s) of the building where occupancy is permitted. Following the issuance of a temporary certificate of occupancy, the regional fire protection engineer shall set a time frame for the completion, inspection, testing and approval of all life safety and fire protection systems, and the correction of any outstanding life safety and fire protection deficiencies. Upon completion, inspection, successful testing and approval of all fire protection and life safety systems and correction of all outstanding fire and life safety deficiencies, the regional fire protection engineer will issue a certificate of occupancy for the entire building to the GSA Project Manager.

7.3 Fire Safety During Construction and Renovations

General. Fire safety during construction and renovations shall comply with the requirements of the International Building Code (IBC), International Fire Code (IFC), and NFPA 241.

Fire Protection Systems. Disruptions to fire alarm and sprinkler systems shall be kept to a minimum or avoided. Delineate phasing of construction to ensure that installations of new systems are expedited, and existing systems are kept in service until the replacement system is operational. If fire protection systems are to be disrupted, procedures shall be incorporated into the design to maintain equivalent levels of fire protection and provide formal notification to the facility while systems are down. The regional fire protection engineer shall make the final determination of the adequacy of proposed equivalent levels of fire protection prior to the disruption of any fire protection system. For example, the provision of a 24 hour fire watch by qualified individuals may provide an equivalent level of fire protection during system disruption in some circumstances.

7.4 Commissioning

The design team's fire-safety engineer shall identify and coordinate commissioning practices with the Construction Manager, Project Manager, and (if contracted separately) the Commissioning Authority, for the project's programmed performance goals. As appropriate, coordinate with other disciplines to fully enable required testing and certifications. Incorporate into construction specifications those testing and certification requirements that involve construction contractors. Examples of possible programmed performance goals include:

- [Fire Alarm System Testing.](#)
- [Smoke Control System Effectiveness.](#)
- [Areas of Refuge Pressurization.](#)
- [Effectiveness of Building Automation System Interface.](#)
- [Functionality of Applied Innovative Technologies.](#)

7.5 Building Construction

Types of Construction. For each construction type, design fire resistive ratings of structural members in accordance with the requirements of the International Building Code.

Panel and Curtain Walls. All panel and curtain walls shall meet the requirements for nonbearing walls in the type of construction involved and shall be securely anchored to the building so as to prevent failure of the anchors during fire.

Fire Stopping. Fire stopping shall be provided in all openings between exterior walls (including panel, curtain, and spandrel walls) and floor slabs, and openings in floors and shaft enclosures, to form an effective fire and smoke barrier between stories.

Fireproofing

All fireproofing (cementitious or fiber) used shall be specified to meet the following requirements:

Sprayed-on Fireproofing.

- *Deflection:* No cracking, spalling or delamination. Test method ASTM E 759.
- *Impact on Bonding:* No cracking, spalling or delamination. Test method ASTM E 760.
- *Corrosion Resistance:* No corrosion. Test method ASTM E 937.
- *Air Erosion:* Maximum weight loss of 0.27 g/m² (0.025 grams per square foot) in 24 hours. Test method ASTM E 859.
- *Burning Characteristics:* Maximum flame spread rating of 10 for concealed fireproofing, 5 for exposed fireproofing, and smoke development rating of 0. Test method ASTM E 84.

Concealed Sprayed-on Fireproofing.

- *Density:* The greater of 240 kg/m³ (15 pounds per cubic foot) or the density required to attain the required fire resistance rating. Test method ASTM E 605.
- *Thickness:* The greater of 10 mm (0.375 inches) or the thickness required for the fire resistive design. Test method ASTM E 605.
- *Bond Strength:* 1030 kPa (150 PSI). Test method ASTM E 736.
- *Compressive Strength:* 35 kPa (5.21 PSI). Test method ASTM E 761.

Exterior Exposed Fireproofing. Fireproofing shall not be exposed to the outside environment unless there are no viable options. However, if this must occur, precautions must be made to protect fireproofing from light, moisture, rain, sleet and snow, and damage from other sources.

7.6 Interior Finishes

The interior finish requirements for walls, ceilings, floors, draperies, curtains, and movable partitions shall meet the requirements of the International Building Code.

Special Requirements. The requirements below supersede the requirements of the International Building Code:

- Adhesives and other materials used for the installation of carpets shall be limited to those having a flash point of 140 degrees F or higher.
- All other materials composed of combustible substances, such as wood (e.g., plywood, 600 mm by 1200 mm (2 feet by 4 feet) wood boards, etc.) shall be treated with fire-retardant chemicals by a pressure-impregnation process or other methods that treats the materials throughout (as opposed to surface treatment).

7.7 Occupancy Classifications

General. Occupancy classifications shall meet the requirements of the International Building Code.



Courtroom, Robert C. Byrd U.S. Courthouse, Charleston, WV

7.8 Means of Egress

General. The egress requirements in NFPA 101 shall be used in lieu of the egress requirements in the International Building Code.

Special Requirements. The requirements below supersede the requirements of the NFPA 101:

- In buildings that are fully sprinklered, 1-hour fire rated corridors shall not be required.
- In buildings that are fully sprinklered, enclosure of the elevator lobbies shall not be required.
- Interlocking (scissor) stairs that occupy a single (communicating) stair shaft shall count as only one exit stair. A minimum of two exit stairs is required for any multi-story building.
- For common paths of travel and dead end corridors, GSA permits the NFPA 101 exceptions for sprinkler protection to apply to fully sprinklered individual floors, even if the other floors of the building are not sprinklered.

Fire Escapes. Fire escapes, as defined in the NFPA 101, shall not be considered approved exits.

Stairway Pressurization. In fully sprinklered new construction having occupied floors located more than 75 feet above the level of exit discharge or more than 30 feet below the level of exit discharge, exit stairways shall be pressurized in accordance with the requirements of the International Building Code.

Stair Identification Signs. In addition to meeting the requirements of the NFPA 101, the stair identification signs shall meet the following requirements:

- The signs shall have a background made of photoluminescent material complying with ASTM E 2072-00 as a minimum standard.
- The signs shall be a minimum size of 12 inches by 12 inches.
- The large letter and number type shall be a minimum of 1-1/2 inches tall.
- The small letter and number type shall be a minimum of 9/16" tall.
- The directional arrows shall be a minimum of 1-3/8 inches tall.
- Letters and numbers on the signs shall have a width-to-height ratio between 3:5 and 1:1; and a stroke width-to-height ratio between 1:5 and 1:10.

For projects in historic structures, the design team shall consult with the Regional Historic Preservation Officer regarding these requirements.

Stair Treads. In addition to meeting the requirements of the NFPA 101, stair treads shall incorporate photoluminescent paint or photoluminescent adhesive strips that are to be applied to the leading edge of the stair tread. Photoluminescent materials shall comply with ASTM E 2072-00 as a minimum standard. For projects in historic structures, the design team shall consult with the Regional Historic Preservation Officer regarding these requirements.

7.9 Water Supply for Fire Protection

Adequacy of Water Supply. The designer shall assess adequacy of the existing water supply. The designer shall perform water supply flow testing of fire hydrants and/or fire pumps. If data less than one year old is available from the local jurisdiction, the designer shall verify the locations involved as well as the quality and accuracy of the data.

Capacity and Duration. The required fire flows and pressures for buildings shall comply with NFPA 13 and the National Model Building Code.

Fire Pump Design. When a fire pump is necessary to supplement fire flow and pressure, size it to comply with NFPA 13, 14, and 20. For emergency power requirements see Chapter 6.

Special Requirements. The requirements below supersede the fire pump requirements of NFPA 13, 14, and 20:

- The fire pump shall be sized only for the sprinkler system requirements unless the local responding fire department cannot provide the necessary flow and pressure for manual fire fighting operations (i.e., hose stations).
- The fire pump shall be electric motor driven, horizontal split case centrifugal type, unless this is not feasible.

Fire Pump Installation

The fire pump shall be installed in accordance with the requirements of NFPA 20.

Fire Pump Operations. A fire pump shall start automatically at 69 kPa (10 psi) below jockey pump start pressure. Fire pumps shall be designed for manual or automatic shut down. Manual shut down of the fire pump will ensure that the pump does not shut down prematurely before controlling the fire.

Fire Pump Controller. The power transfer switch and the fire pump controller shall be factory assembled and packaged as a single unit. Separate transfer switches are not permitted. The fire pump controller shall be monitored by the fire alarm system.

Jockey Pump. A jockey pump shall be utilized where it is desirable to maintain a uniform or relatively high pressure on the fire protection system. A jockey pump shall be sized to make up the allowable leakage rate within 10 minutes or 1 gpm, whichever is larger.

7.10 Water Based Fire Extinguishing Systems

Automatic Sprinkler System Installation

Automatic sprinklers systems shall be installed throughout all new construction projects and in all major renovation projects in accordance with the requirements of NFPA 13, the International Building Code, and the appropriate GSA sprinkler system specification.

Special Requirements: The requirements below supersede the requirements of NFPA 13 and the International Building Code:

- Automatic sprinklers shall be installed in all new construction projects and in all renovation projects. This includes elevator machine rooms, boiler rooms, mechanical equipment rooms, walk-in freezers and cold rooms, essential electronic facilities, electrical closets, telephone closets, emergency generator rooms, uninterruptible power service and battery rooms, electrical switchgear rooms, transformer vaults, telephone exchange (PABX) rooms, etc.
- All sprinkler systems shall be wet-pipe sprinkler systems, unless installed in areas subject to freezing.
- In areas subject to freezing, install dry-pipe sprinkler systems, dry pendent sprinklers, or provide heat in the space, and/or reroute the sprinkler piping. Heat tape shall not be used on sprinkler piping.
- Antifreeze sprinkler systems shall not be installed in any new construction or renovation projects.
- Pre-action type sprinkler systems shall not be installed in any new construction or renovation projects.

Sprinkler System Design

Sprinkler systems shall be hydraulically calculated in accordance with the requirements specified in NFPA 13.

Special Requirements. The requirements below supersede the design requirements of NFPA 13:

- Sprinkler systems shall be designed using a minimum system design area of 1,500 sq. ft. and shall not be decreased below this value.
- In rooms containing movable/mobile shelving (high density storage) the sprinkler design shall be Ordinary Hazard (Group 2) using quick response sprinklers.

Seismic Protection. Seismic protection shall be installed where required by the International Building Code.

Types of Sprinklers

Quick response sprinklers (QRS) shall be installed in all new construction and renovation projects in accordance with the requirements specified in NFPA 13.

Special Requirements. The requirements below supersede the requirements of NFPA 13:

- All sprinklers installed in any new construction or renovation projects shall be both Underwriters Laboratories Inc. (UL) listed and Factory Mutual Engineering and Research Corporation (FM) approved.
- All quick response glass bulb sprinklers shall be equipped with a protective device to reduce damage prior to installation. The protective device shall be removed after sprinklers are installed.
- U.L. listed concealed sprinklers are allowed only when approved by the GSA regional fire protection engineer.
- Sprinklers equipped with "O-ring" water seals shall not be utilized in any new construction or renovation projects.
- All sprinkler escutcheons installed in any new construction or renovation projects shall be Underwriters Laboratories Inc. (UL) listed or Factory Mutual Engineering and Research Corporation (FM) approved.

- QRS sprinklers shall not be installed in high temperature areas (e.g., high temperature areas defined in NFPA 13 or elevator machine rooms, etc.) in a building. Standard response sprinklers shall be installed of the appropriate temperature rating.
- Flow control (On-off) sprinklers shall not be installed in any new construction or renovation projects.
- All automatic sprinklers installed less than 7 feet above the floor shall be equipped with sprinkler guards to provide protection against accidental damage.

Sprinkler Piping System

Sprinkler piping, fittings, control valves, check valves, and drain assemblies shall meet the requirements of NFPA 13.

Special Requirements. The requirements below supersede the requirements of NFPA 13:

- Black steel piping and/or copper tubing shall be used for all wet-pipe sprinkler piping. Chlorinated polyvinyl chloride (CPVC) sprinkler piping shall be allowed to be installed only when approved by the GSA regional fire protection engineer.
- Galvanized (internal and external) sprinkler piping shall be used for all dry-pipe sprinkler systems.
- Steel pipe sizes 2 inches and smaller shall be Schedule 40 and shall be threaded.
- Steel pipe sizes larger than 2 inches shall be minimum Schedule 10. Piping less than Schedule 40 shall be roll grooved.
- Threadable lightwall pipe shall not be used.
- Piping having a corrosion resistant ratio less than 1 shall not be used.
- Plain-end fittings shall not be used.

Special Sprinkler System Requirements Sprinklers In Spaces Housing Electrical Equipment.

- All elevator machine rooms shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible location. Tamper switches shall be provided on all such valves.
- All electrical switchgear rooms and transformer vaults shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible location. Tamper switches shall be provided on all such valves.
- All essential electronic facilities shall be provided with separate manual isolation valves and a separate water flow switch located outside the room in an accessible location. Tamper switches shall be provided on all such valves.
- Sprinklers installed in electrical rooms and electrical closets shall be equipped with sprinkler guards to provide protection against accidental damage.

Places of Confinement.

- QRS institutional sidewall sprinklers shall be installed in the corridor outside each of the U.S.M.S. prisoner detention cells.
- QRS sprinklers shall be located such that the spray pattern of the sprinklers penetrates through the bars of the cell.
- QRS sprinklers shall not be installed inside individual U.S.M.S. prisoner detention cells.

7.11 Non-Water Based Fire Extinguishing Systems

Wet Chemical Extinguishing Systems. Wet chemical extinguishing systems shall be installed in all commercial cooking equipment installations, and installed in accordance with NFPA 17A.

Dry Chemical Extinguishing Systems. Dry chemical extinguishing systems shall not be installed in any commercial cooking equipment installations.

Clean Agent Extinguishing Systems. Clean agent extinguishing systems shall not be installed in any new construction or renovation projects.

7.12 Standpipes and Fire Department Hose Outlets

Standpipes. Standpipes shall be installed in buildings where required by the National Model Building Code.

Special Requirements. The requirements below supersede the requirements of the National Model Building Code:

- All standpipes shall be connected to the fire protection water supply, be permanently pressurized, and be installed in accordance with NFPA 14.
- Dry standpipes shall only be permitted in spaces subject to freezing.
- Where standpipe and sprinkler systems are required, a combination sprinkler/standpipe system design shall be provided.

Fire Department Hose Outlets. Each fire main riser shall be provided with 2-1/2 inch fire department hose outlets. Each outlet shall be located in the stair shaft and have a removable 1-1/2 inch adapter and cap. Threads and valves shall be compatible with the local fire department requirements.

7.13 Portable Fire Extinguishers and Cabinets

Portable fire extinguishers and cabinets shall be installed in accordance with the requirements of the International Building Code.

Special Requirements. The requirements below supersede the requirements of the International Building Code:

- Portable fire extinguishers and cabinets shall not be installed in common areas, general office or court space when the building is protected throughout with quick response sprinklers.
- In office buildings protected throughout with quick response sprinklers, fire extinguishers shall only be installed in areas such as mechanical and elevator equipment areas, computer rooms, UPS rooms, generators rooms, kitchen areas, special hazard areas, etc.

7.14 Fire Protection for Storage Facilities

General Storage. The storage arrangements and protection of a general storage facility shall meet the requirements of NFPA 13 and NFPA 231.

Rack Storage. The storage arrangements and protection of a rack storage facility shall meet the requirements of NFPA 13, NFPA 231 and NFPA 231C.

Record Storage. The storage arrangements and protection of a record storage facility shall meet the requirements of NFPA 13 and NFPA 232.

Archive and Record Center. The storage arrangements and protection of an archive and record center shall meet the requirements of NFPA 13, NFPA 232 and the information provided in NFPA 232A and the National Archives and Records Administration guidelines as published in the Federal Register, GSA sponsored large scale fire testing.

Special Requirements. The requirements below supersede the requirements of NFPA 232.

- Smoke detectors shall be installed throughout archival storage areas in accordance with the requirements of NFPA 72.



Vincent E. McKelvey Federal Building, Menlo Park, CA

Track Files. A track file uses a single aisle to give access to an otherwise solid group of open-shelf files. Access is gained by moving shelf units on rollers along a track until the proper unit is exposed.

- The track file system shall be constructed entirely of steel. At least 1.4 mm (18-gauge) sheet metal shall be used for all parts of the shelving unit.
- The system shall be no more than 2400 mm (8 feet) high, and a minimum clearance of 460 mm (18 inches) shall be maintained between the top of the shelving and the ceiling.
- The sprinkler density shall be 12.2 (L/min)/ m² (0.3 gpm/sq ft) over 139 m² (1500 sq ft). Sprinkler spacing shall be 9.3 m² (100 ft²) maximum.

- Clearance between units shall be a minimum 2 inches when filing system is in the closed position. To accomplish this mount bumpers on the face of each unit.
- The back cover of stationary end files shall be solid sheet metal.
- For floor loading requirements see Chapter 4.

Flammable and Combustible Liquid Storage. The storage arrangements and protection of a flammable and combustible liquid storage area shall meet the requirements of NFPA 30 and the applicable Factory Mutual Data Sheets.

7.15 Special Fire Protection Requirements

Sprinkler Protection. Each elevator machine room shall be provided with a wet-pipe sprinkler system using standard response sprinklers.

Power Disconnect. Activation of the dedicated elevator machine room water flow switch shall simultaneously disconnect all power to the elevator equipment within the elevator machine room and notify the fire alarm system of the condition and the location of the waterflow.

Smoke Detectors. Smoke detectors for elevator recall shall be installed in each elevator lobby and each elevator machine room.

Essential Electronic Facilities

Essential electronic facilities consist of spaces that have high value or mission essential electrical equipment such as mainframe computers or telephone switches with the potential for high dollar loss and/or business interruption. Essential electronic facilities shall be designed in accordance with NFPA 75 and the appropriate GSA computer room fire alarm system specification.

Special Requirements. The requirements below supersede the requirements of NFPA 75.

- A wet pipe sprinkler system shall be provided throughout the facility including data storage areas.
- Quick response sprinklers shall be used throughout the facility including data storage areas.
- The sprinkler system shall have a separate isolation valve and a separate water flow switch located outside

of each protected area. Each valve shall be provided with a tamper switch that is connected to the building's fire alarm system.

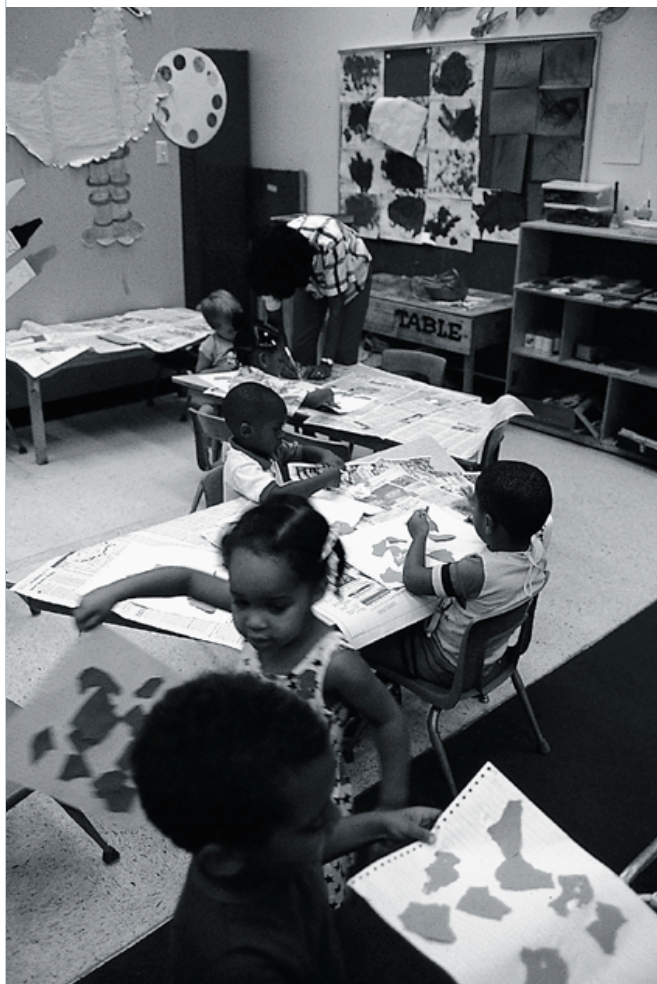
- Activation of the sprinkler water flow switch shall disconnect power to the computers and to the HVAC systems with no time delay.
- The activation of two cross-zoned conventional photoelectric smoke detectors or the activation of one intelligent analog/addressable photoelectric smoke detector utilizing early warning smoke detection technology (e.g., smoke detectors having enhanced algorithms, fire alarm control panel having capability to program individual smoke detector response parameters, or smoke detectors using air sampling technology for use in essential electronic facilities, etc.) within a single protected area shall disconnect power to the computer equipment and to the HVAC system after a pre-set time delay.



EPA Headquarters

Elevator Systems

Entrapment Prevention: When the regional fire protection engineer has determined that there may be a possibility that occupants may get trapped in an elevator cab due to the power shut-down of the elevator controller prior to complete elevator recall via Phase I Emergency Recall Operation, earthquake mode emergency condition software shall be incorporated into the project. The



Child Care Center

earthquake mode emergency condition software is available on all manufacturer microprocessors. Normally, the elevator displacement switch initiates the earthquake mode emergency condition. When the displacement switch is activated, the elevators, if in motion, proceed to the nearest available landing and park with their doors open and shut down. The project shall incorporate the installation of heat detector(s) in the elevator machine room(s) to initiate the “earthquake mode” emergency condition software protocol in lieu of or in addition to the elevator displacement switch depending on the seismic region in which the building is located. The heat detectors installed shall have both lower temperature rating and higher sensitivity as compared to the automatic sprinklers within the elevator machine rooms.

The following operating sequence would apply:

- Prior to activation of sprinklers, a signal shall be received from heat detectors in the machine room and the input connected to the elevator controllers.
- When the signal is received into the microprocessor, it will activate “earthquake mode”. The “earthquake mode” is available on all manufacturer microprocessors and is required on all elevators in regions of moderate and high seismicity.
- When the signal from the heat detector is received, the “earthquake mode” rescue sequence shall be activated. The cars will proceed to the closest available landing and park with their doors open.

Elevator systems shall be designed and installed in accordance with ANSI/ASME Standard A17.1.

Atrium Smoke Removal System

An atrium smoke removal system shall be designed and installed in accordance with the requirements of the International Building Code. Additional design guidance may be found in NFPA 92B.



Vincent E. McKelvey Federal Building laboratory wing, Menlo Park, CA

Smoke Control Systems

Smoke control systems shall be designed and installed in accordance with the International Building Code. Additional design guidance may be found in NFPA 92A, the ASHRAE/SFPE manual, *Design of Smoke Management Systems*, and NFPA publication, *Smoke Movement and Control in High Rise Buildings*.

Fire Protection Requirements for Cooling Towers

Cooling towers shall be in accordance with NFPA 214.

Special Requirements. The requirements below supersede the requirements of NFPA 214.

- Cooling towers over 2000 cubic feet in size, having combustible fill, shall be provided with an automatic deluge sprinkler system.
- Automatic sprinkler protection shall not be required in cooling towers over 2000 cubic feet in size, constructed

of non-combustible materials, having non-combustible components (including piping) and non-combustible decks.

- Automatic sprinkler protection is required for cooling towers which are constructed of combustible materials, have combustible components (such as PVC fill, louvers, drift eliminators, etc.), or a combustible deck.

Child Care Centers

For special fire protection requirements for Child Care Centers see the GSA document *Child Care Center Design Guide* (PBS-P140).

Courthouses

For special fire protection requirements for Courthouses see the document *U.S. Courts Design Guide*.

Border Stations

For special fire protection requirements for Border Stations see the document *U.S. Border Station Design Guide*.

Laboratories

Laboratories shall meet the design requirements in NFPA 45 and the International Building Code.

Special Requirements. The requirements below supersede the requirements of NFPA 45.

- Laboratories handling or storing hazardous chemicals, flammable gases, flammable liquids, explosives, and biological laboratories shall not be expanded in existing office buildings.
- All chemical laboratories (not photo labs, unless they utilize large quantities of flammable liquids) shall be sprinklered, regardless of size. Sprinkler protection shall be calculated to provide a density of 0.15 gpm per sq. ft. over a 3,000 sq. ft. area.

7.16 Emergency Power, Lighting and Exit Signage

Emergency and Standby Power Systems. Emergency and standby power shall be installed and meet the performance requirements of NFPA 70, NFPA 110, and NFPA 111.

Emergency Lighting. Emergency lighting shall be installed and meet the performance requirements of the NFPA 101.

Exit Signage: Exit signage shall be installed and meet the performance requirements of the NFPA 101.

7.17 Fire Alarm Systems

Fire Alarm System Installation

New and replacement fire alarm systems shall be installed in accordance with the requirements of NFPA 72, the International Building Code, and the appropriate GSA fire alarm system specification.

Special Requirements: The design requirements below supersede the requirements of NFPA 72 and the International Building Code:

- All new and replacement fire alarm systems shall be addressable systems as defined in NFPA 72.
- All new and replacement fire alarm systems installed in buildings having a total occupant load of 500 or more occupants or subject to 100 or more occupants below the level of exit discharge shall be a voice/alarm communication system. The voice/alarm communication system shall provide an automatic response to the receipt of a signal indicative of a fire emergency. Manual control capability shall also be provided to notify all occupants either on a selective or all-call basis during an emergency.
- Fire alarm systems shall not be integrated with other building systems such as building automation, energy management, security, etc. Fire alarm systems shall be self-contained, stand alone systems able to function independently of other building systems.
- Each fire alarm system shall be provided with a hardwired mini-computer power conditioner to protect the fire alarm system from electrical surges, spikes, sags, over-voltages, brownouts, and electrical noise. The power conditioner shall be U.L. listed and shall have built in overload protection.

- Wiring supervision for fire alarm systems shall be provided as defined in NFPA 72 as follows:
 - Interconnected riser loop or network (Style 7 – Class A)
 - Initiating device circuits (Style B – Class B)
 - Signaling line circuit for each floor (Style 4 – Class B)
 - Signaling line circuit for network (Style 7 – Class A)
 - Notification appliance circuits (Style Y – Class B)
- All fire alarm system wiring shall be solid copper and installed in conduit. Stranded wiring shall not be used.
- Conduit shall be rigid metal or electrical metallic tubing, with a minimum inside diameter of 3/4 inch, that utilizes compression type fittings and couplings.

Manual Fire Alarm Stations

Manual fire alarm stations shall be installed in accordance with the requirements of NFPA 72 and the International Building Code.

Special Requirements. The design requirements below supersede the requirements of NFPA 72 and the International Building Code:

- Manual fire alarm stations shall be double-action and installed in every facility in accordance with the spacing and location requirements in NFPA 72.

Waterflow

Waterflow switch(es) shall be installed in accordance with the requirements of NFPA 13, NFPA 72 and the International Building Code.

Special Requirements. The design requirements below supersede the requirements of NFPA 72 and the International Building Code:

- Waterflow switch(es) shall be installed at each floor or fire area protected by sprinkler systems.

Smoke Detectors

Smoke detectors shall be installed in accordance with the requirements of NFPA 72, NFPA 90A, and the International Building Code.

Special Requirements. The design requirements below supersede the requirements of NFPA 72, NFPA 90A, and the International Building Code:

- Smoke detectors shall not be installed in each of the following rooms: mechanical equipment, electrical closet, telephone closet, emergency generator room, uninterruptible power service and battery rooms, or similar rooms.
- Appropriate type smoke detection shall be installed in each of the following rooms: electrical switch gear, transformer vaults and telephone exchanges (PABX).

Audible Notification Appliances

Performance, location, and mounting of audible notification appliances shall be in accordance with the requirements of NFPA 72.

Special Requirements. The design requirements below supersede the requirements of NFPA 72:

- To ensure audible signals are clearly heard, the sound level shall be at least 70 dBA throughout the office space, general building areas and corridors measured 5 feet above the floor. The sound level in other areas shall be at least 15 dBA above the average sound level or 5 dBA above any noise source lasting 60 seconds or longer.
- The design for the placement and location of all audible notification appliances shall be based on the applicable calculation methods contained in *The SFPE Handbook of Fire Protection Engineering* for calculating sound attenuation through doors and walls.

- Where voice communication systems are provided, fire alarm speakers shall be installed in elevator cabs and exit stairways; however they shall only be activated to broadcast live voice messages (e.g., manual announcements only). The automatic voice messages shall be broadcast through the fire alarm speakers on the appropriate floors, but not in stairs or elevator cabs.

Visible Notification Appliances

Placement and spacing of visible notification appliances shall be in accordance with the requirements of NFPA 72.

Special Requirements. The design requirements below supersede the requirements of NFPA 72:

- Visual notification appliances shall only be installed in projects that involve the installation of a new fire alarm system.
- Visual notification appliances shall only be required to be installed in public and common areas. For the purposes of this requirement, visual notification appliances shall not be required to be installed in individual offices. Public and common areas include public rest rooms, reception areas, building core areas, conference rooms, open office areas, etc.
- Visual notification appliance circuits shall have a minimum of 25 percent spare capacity to accommodate additional visual notification appliances being added to accommodate employees who are deaf or have hearing impairments.
- Visual notification appliances shall not be installed in exit enclosures (i.e., exit stairs, etc.).

Fire Alarm Messages for High Rise Occupancies

Upon receipt of any fire alarm signal, the fire alarm system shall automatically activate a distinctive three-pulse temporal pattern for three (3) cycles followed by the automatic voice messages which shall be repeated until the control panel is reset (i.e., three-pulse temporal pattern - three-pulse temporal pattern - three-pulse temporal pattern - voice message; three-pulse temporal pattern - three-pulse temporal pattern - three-pulse temporal pattern - voice message; etc.).

The automatic voice messages shall be broadcast through the fire alarm speakers on the appropriate floors, but not in stairs or elevator cabs.

The “Fire Zone” message shall be broadcast through speakers on the floor of alarm origin, the floor immediately above the floor of origin, and the floor immediately below the floor of origin. In addition, the visual alarm indicating circuit(s) shall be activated on the floor of alarm origin, the floor immediately above the floor of origin, and one floor immediately below the floor of origin. A first floor alarm shall transmit a “Fire Zone” message to all below grade levels.

The “Safe Area Zone” message shall simultaneously be broadcast to all other building floors. However, the visual alarm indicating circuit(s) shall not be activated on these floors. The “Safe Area Zone” message shall activate for two complete rounds and silence automatically. After five minutes, the “Safe Area Zone” message shall automatically start and activate for two complete rounds and silence again. This sequence shall be repeated until the fire alarm system is reset. In the event a subsequent fire alarm is received at the fire alarm control panel by a floor that was previously receiving a “Safe Area Zone” message, this floor shall automatically revert to perform the actions for a “Fire Zone” message.

A live voice message shall override the automatic output through use of a microphone input at the control panel. When using the microphone, live messages shall be broadcast through speakers in stairs, in elevator cabs, and throughout a selected floor or floors. All stairwell speakers shall have a dedicated zone activation switch. All elevator speakers shall have a dedicated zone activation switch. An “All Call” switch shall be provided which activates all speakers in the building simultaneously.

Messages shall be digitized voice and utilize a professional quality male voice and shall be as follows:

- **“Fire Zone” Message:** “May I have your attention, please. May I have your attention, please. A fire has been reported which may affect your floor. Please walk to the nearest exit and leave the building. Please do not use the elevators,” or
- **“Fire Zone” Message:** “May I have your attention, please. May I have your attention, please. A fire has been reported which may affect your floor. Please walk to the nearest exit, walk down ____ floors, re-enter the building, walk onto the floor, and await further instructions. Please do not use the elevators.”
- **“Safe Area Zone” Message:** “May I have your attention, please. May I have your attention, please. A fire has been reported in another area of the building. You are in a safe area. Please stay in your work area and await further instructions. Please do not use the elevators.”

Graphic Annunciator

All fire alarm systems shall have at least one graphic annunciator located at the entrance to the building that the fire department enters.

Survivability

Special Requirements. The requirements below are in addition to the survivability requirements specified in NFPA 72.

- At least two vertical risers shall be installed as remote as possible from each other. A minimum two-hour fire rated assembly, shaft, or enclosure, not common to both risers shall protect one riser. A minimum one-hour fire rated assembly, shaft, or enclosure shall protect the second riser. A minimum one-hour fire rated assembly, shaft, or enclosure shall protect the horizontal interconnection between the two risers.
- A minimum of two (2) distinct fire alarm audible appliance circuits and a minimum of two (2) distinct visible appliance circuits shall be provided on each floor.
- Adjacent fire alarm audible and visual appliances shall be on separate circuits.

Fire Command Center

The fire command center shall be provided in a location approved by the regional fire protection engineer after consultation with the local fire department.

The equipment and contents of the fire command center shall meet the requirements of the International Building Code.

The fire command center shall be enclosed by 1-hour fire resistant construction. Appropriate lighting, ventilation, and emergency lighting shall be provided.



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7.18 Historic Structures

For an overall fire protection plan and to emphasize the Design Team's responsibility to address fire protection and to preserve the historic integrity of historic structures, the Design Team shall explore alternative approaches outlined in state rehabilitation codes, International Existing Building Code (IEBC), and performance based codes to resolve conflicts between prescriptive code requirements and preservation goals. In addition, the requirements and recommendations of NFPA 914 shall be considered for rehabilitation projects in historic structures. The Design Team shall also evaluate the HUD Guideline *Fire Ratings of Archaic Materials and Assemblies* that provides test data on the fire resistance of a variety of historic materials and GSA publication titled *Fire Safety Retrofitting in Historic Buildings*.

GSA's regional fire protection engineer serves as the AHJ, who must exercise professional judgement to assess the acceptability of alternative compliance solutions. Early and frequent coordination between the architects, State Historic Preservation Officer, Regional Historic Preservation Officer, preservation specialists, external review groups, and the Design Team's fire protection engineer is imperative to timely resolution of conflicts between fire safety and preservation goals.

Fire Protection Alternatives for Consideration. Listed below are fire protection alternatives for the Design Team's fire protection engineer to consider when designing a project:

- New stair enclosures in historic buildings should be designed to minimize visual impact on significant spaces, including historic lobbies and corridors. Cross-corridor doors should be designed to provide maximum height and width clearance and avoid visually



Spokane Federal Building/U.S. Post Office

truncating the corridor. Oversized hold-open doors will achieve this end in most circumstances. For more ornamental spaces, accordion rated doors may be used. Transparent treatments, such as rated glass assemblies or historic doors modified to incorporate rated glass should be considered when barriers must be kept closed to maintain a rated enclosure. Non-prescriptive compliance solutions, such as modification of historic door assemblies, must be approved by GSA's regional fire protection engineer.

- New fire-rated doors in preservation zones should be designed to resemble historic doors in panel detailing and finish. True-paneled fire doors are preferred for replacement of original paneled stair or corridor doors.
- In historically significant spaces, sprinklers should be carefully placed to minimize damage to ornamental materials. Develop detailed drawings for architecturally sensitive areas, showing precise sprinkler locations and finishing notes as necessary to ensure proper installation. Sprinklers should be centered and placed symmetrically in relation to ornamental patterns and architectural features defining the space, such as arched openings.
- Sprinklers and escutcheons should match original architectural surfaces or hardware. Oxidized brass or bronze heads are recommended for use in deeply colored (unpainted) woodwork. In elaborately decorated ceilings, heads should be camouflaged by custom coating and omitting escutcheon plates. In such cases, low profile, quick response sprinklers are preferred.
- In historically significant spaces, smoke detectors should be carefully placed to minimize destruction of ornamental surfaces. Where ceilings are elaborately embellished, explore alternative detection products and approaches such as air sampling detection, projected beam, low profile spot detectors, recessed installation, or custom-coating detector housings to blend with ornamental finishes. Application of special finish treatments outside of the standard factory process must be coordinated with, and approved in writing by, the manufacturer to ensure that UL labels and detector performance are not compromised. Smoke detector housings must be removed prior to application of special finishes.